

SIMULATION OF SPREAD OF RADIOACTIVE CONTAMINATION BY ARCGIS SERVICES

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After one year of the terrible disaster at Fukushima NPP the ecological security of every nuclear facility from a huge nuclear energy reactor to a small research reactor is a topic of a big interest. The radioecological monitoring is an essential part of the safety assurance of these facilities.

Simulation is an important part of a radiological monitoring which is based on radiological and meteorological data which is collected, stored into the database and analyzed before the simulation.

Before the data will be downloaded to the database it has to be prepared in the format which is standardized and understandable for the software of the radiological monitoring system. NetCDF(network Common Data Form) is commonly used format in climatology, meteorology and oceanography applications (e.g., weather forecasting, climate change) and GIS applications that is why it can be used for representing meteorological and radiological data in radiological monitoring system [1].

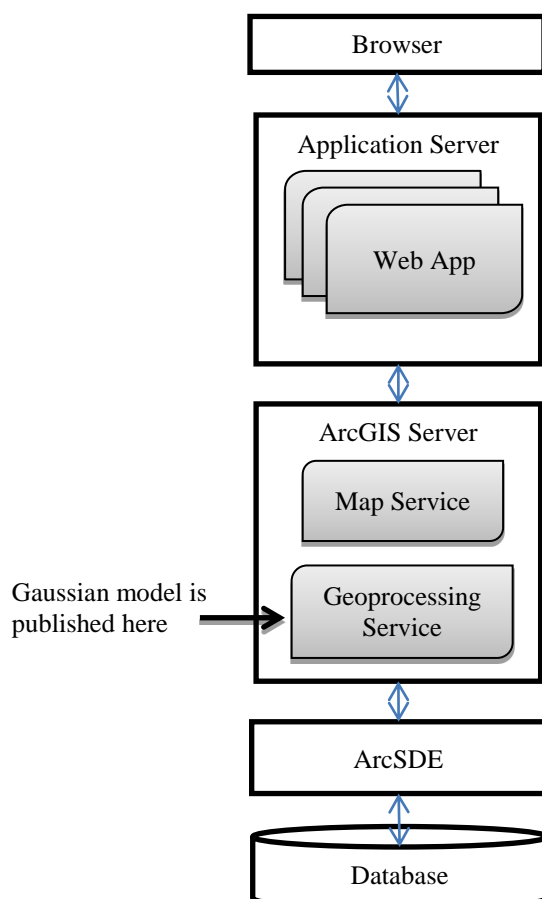
Nowadays online systems which use Web become much popular because no software needs to be install at user's desktop, laptop or other device and this software which is accessible in any browser is always up-to-day because all business logic can be updated only on server. That's why radiological monitoring systems should be Web system and use spatial data. ArcGIS software is used for these purposes. It can show the spatial data of the territory (a map), radiological and meteorological data. ArcSDE is used for access for spatial data which is in the database; ArcGIS Server is used for publication these data as MapServer.

Gaussian dispersion model is used for simulation the area polluted with radionuclides in the case of the emergency at a nuclear facility [2]. With this formula the concentration in the point (x,y,z) is calculated according to the condition of the facility, the emergency and meteorological data.

$$C(x, y, z) = \frac{QKV}{2\pi u_s \sigma_y \sigma_z} * \exp\left(-0.5 \frac{y^2}{\sigma_y^2}\right).$$

In this work all calculations of the activity spread are moved not even to Application Server but to ArcGIS Server which performs all of these calculations faster. The model which is created with ArcGIS ModelBuilder is published on ArcGIS Server and is accessible from the browser [2].

The architecture of the system is shown on the following figure and consists of thin client application, two servers and database management system.



This architecture and data storage provides access to online simulation of spread of radioactive pollution in the atmosphere which is important for acceleration of calculations in the case of an emergency.

References:

1. Tim Whiteaker Animating NetCDF Data in ArcMap [link <http://www.crrw.utexas.edu/gis/gishydro06/SpaceAndTime/NetCDF/Animating%20netCDF%20Data%20in%20ArcMap.htm>]
2. Steven G Homann HotSpot Health Physics Codes, 2011 [link <https://nrc.lnl.gov/HotSpot/HotSpot-UserGuide-2-07-2.pdf>]
3. Kevin Armstrong ModelBuilder: an Introduction [link http://proceedings.esri.com/library/userconf/serug09/papers/tw/modelbuilder_introduction.pdf]